

WHAT IS CLAIMED IS:

1. An apparatus for creating a path between a first network element and a second network element included in a bi-directional line switched ring, the bi-directional line switched ring including a third network element, the third network element being arranged to be in communication with the first network element across a first link, the third network element further being arranged to be in communication with the second network element across a second link, the apparatus comprising:

a querying device, the querying device being arranged to substantially automatically identify at least a first time slot associated with the first link, the first time slot being available for use in transferring data between the first network element and the third network element, the querying device further being arranged to substantially automatically identify at least a second time slot associated with the second link, the second time slot being available for use in transferring data between the third network element and the second network element;

a comparator, the comparator being arranged to compare the first time slot and the second time slot to determine when the first time slot and the second time slot are consistent; and

a path computing device, the path computing device being arranged to substantially automatically compute the path between the first network element and the second network element using the first time slot of the first link and the second time slot of the second link when the first time slot and the second time slot are consistent.

2. An apparatus according to claim 1 wherein the querying device is further arranged to identify substantially all time slots associated with the first link that are available for use in transferring data between the first network element and the third network element, and to identify substantially all time slots associated with the second link that are available for use in transferring data between the third network element and the second network element.

3. An apparatus according to claim 2 wherein the time slots associated with the first link that are available for use in transferring data between the first network element and the third network element are time slots that are currently available for use in transferring data between the first network element and the third network element, and wherein the time slots associated with the second link that are available for use in transferring data between the third network element and the second network element are time slots that are currently available for use in transferring data between the third network element and the second network element.

4. An apparatus according to claim 2 wherein the comparator is further arranged to compare the time slots associated with the first link that are available for use in transferring data between the first network element and the third network element and the time slots associated with the second link that are available for use in transferring data between the third network element and the second network element to identify a subset of time slots associated with the first link that are consistent with a subset of time slots associated with the second link.

5. An apparatus according to claim 4 wherein the subset of time slots associated with the first link that are consistent with the subset of time slots associated with the second link form a set of slot segments that are available between the first network element and the second network element, the apparatus further including:

a virtual link identifier, the virtual link identifier being arranged to provide the first network element with at least a first indicator which identifies the set of slot segments as being available for use in creating the path between the first network element and the second network element.

6. An apparatus according to claim 5 wherein the virtual link identifier is further arranged to provide the first network element with at least a second indicator which identifies the first time slot as being available for use in creating the path between the first network element and the second network element.

7. An apparatus according to claim 6 further including:

a physical link identifier, the physical link identifier being arranged to provide the first network element with at least a third indicator which identifies the first time slot as being available for use on the first link.

8. An apparatus according to claim 5 wherein the path computing device is further arranged to compute the path between the first network element and the second network element using a first slot segment selected from the set of slot segments.

9. A computing device, the computing device arranged to be included in a bi-directional line switch ring in a network that includes a plurality of network elements, the computing device further being arranged to be in communication with a first network element of the plurality of network elements through a first link, the first network element further being in communication with a second network element of the plurality of network elements through a second link, the computing device comprising:

computer code that causes querying, the computer code that causes querying being suitable for identifying at least a first time slot associated with the first link, the first time slot being available for use in transferring data between the computing device and the first network element, the computer code that causes querying further being suitable for identifying at least a second time slot associated with the second link, the second time slot being available for use in transferring data between the first network element and the second network element;

computer code that causes comparing, the computer code that causes comparing being suitable for comparing the first time slot and the second time slot to determine when the first time slot and the second time slot are consistent;

computer code that causes computing, the computer code that causes computing being suitable for computing a path between the computing device and the second network element using the first time slot of the first link and the second time slot of the second link when the first time slot and the second time slot are consistent;

a processor that executes the computer codes; and
a computer readable medium that stores the computer codes.

10. A computing device according to claim 9 wherein the computer code that causes
5 querying further identifies substantially all time slots associated with the first link that are
available for use in transferring data between the computing device and the first network
element, and further identifies substantially all time slots associated with the second link
that are available for use in transferring data between the first network element and the
second network element.

10 11. A computing device according to claim 10 wherein the computer code that causes
comparing is suitable for comparing the time slots associated with the first link that are
available for use in transferring data between the computing device and the first network
element and the time slots associated with the second link that are available for use in
15 transferring data between the first network element and the second network element to
identify a subset of time slots associated with the first link that are consistent with a
subset of time slots associated with the second link.

20 12. A computing device according to claim 11 wherein the subset of time slots
associated with the first link that are consistent with the subset of time slots associated
with the second link form a set of slot segments that are available between the first
network element and the second network element, the computer device further including:
computer code that causes a virtual link to be identified, the computer code that
causes the virtual link to be identified further being suitable for providing at least a first
25 indicator which identifies the set of slot segments as being available for use in creating
the path between the computing device and the second network element.

13. A computing device according to claim 12 further including:

computer code that causes a physical link to be identified, the computer code that causes the physical link to be identified being suitable for providing at least a third indicator which identifies the first time slot as being available for use on the first link.

5 14. A computing device according to claim 12 further including:

computer code that causes bandwidth to be determined, wherein the computer code that causes the bandwidth to be determined is arranged to determine a substantially maximum bandwidth associated with the set of slot segments.

10 15. A computing device according to claim 14 wherein the computer code that causes the bandwidth to be determined is further arranged to determine a substantially minimum bandwidth associated with the set of slot segments.

15 16. A computing device according to claim 12 wherein the computer code that causes computing is further suitable for computing the path between the computing device and the second network element using a first slot segment selected from the set of slot segments.

20 17. A computing device according to claim 16 wherein the computing device further includes:

computer code that causes data to be received; and

computer code that causes data to be forwarded from the computing device to the second network element across the path.

25 18. A computing device according to claim 9 wherein the computer readable medium is one selected from the group consisting of a hard disk, a CD-ROM, a DVD, a computer disk, a tape drive, a computer memory, and a data signal embodied in a carrier wave.

30 19. An apparatus for creating a path between a first network element and a second network element included in a bi-directional line switched ring, the bi-directional line

switched ring including a third network element, the third network element being in communication with the first network element across a first link, the third network element further being in communication with the second network element across a second link, the apparatus comprising:

5 means for querying, the means for querying being arranged to substantially automatically identify at least a first time slot associated with the first link, the first time slot being available for use in transferring data between the first network element and the third network element, the means for querying further being arranged to substantially automatically identify at least a second time slot associated with the second link, the
10 second time slot being available for use in transferring data between the third network element and the second network element;

means for comparing, the means for comparing being arranged to compare the first time slot and the second time slot to determine when the first time slot and the second time slot are consistent; and

15 means for computing, the means for computing being arranged to substantially automatically compute the path between the first network element and the second network element using the first time slot of the first link and the second time slot of the second link when the first time slot and the second time slot are consistent.

20 20. An apparatus according to claim 19 wherein the means for querying is further arranged to identify substantially all time slots associated with the first link that are available for use in transferring data between the first network element and the third network element, and to identify substantially all time slots associated with the second link that are available for use in transferring data between the third network element and
25 the second network element.

21. An apparatus according to claim 20 wherein the time slots associated with the first link that are available for use in transferring data between the first network element and the third network element are time slots that are currently available for use in
30 transferring data between the first network element and the third network element, and

wherein the time slots associated with the second link that are available for use in transferring data between the third network element and the second network element are time slots that are currently available for use in transferring data between the third network element and the second network element.

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22. An apparatus according to claim 20 wherein the means for comparing is further arranged to compare the time slots associated with the first link that are available for use in transferring data between the first network element and the third network element and the time slots associated with the second link that are available for use in transferring data between the third network element and the second network element to identify a subset of time slots associated with the first link that are consistent with a subset of time slots associated with the second link.

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23. An apparatus according to claim 22 wherein the subset of time slots associated with the first link that are consistent with the subset time slots associated with the second link form a set of slot segments that are available between the first network element and the second network element, the apparatus further including:

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means for identifying at least one virtual link, the means for identifying the at least one virtual link being arranged to provide the first network element with at least a first indicator which identifies the set of slot segments as being available for use in creating the path between the first network element and the second network element.

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24. An apparatus according to claim 23 further including:

means for identifying at least one physical link, the means for identifying the at least one physical link being arranged to provide the first network element with at least a third indicator which identifies the first time slot as being available for use on the first link.

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25. An apparatus according to claim 24 wherein the apparatus is in direct communication with the first network element.

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26. An apparatus for creating a path between first and second network elements in a bi-directional line switched ring, the apparatus comprising:

a querying device that automatically identifies a first time division multiplexed (TDM) time slot in a first link between the first network element and a third network element and a second TDM time slot in a second link between the third network element and the second network element;

a comparator that determines when the first time slot and the second time slot are consistent; and

a path computing device that substantially automatically computes a path between the first and second network elements using the first and second links when the first and second time slots are consistent.

27. An apparatus according to claim 26 wherein the querying device is further arranged to identify substantially all TDM time slots in the first link and to identify substantially all TDM time slots in the second link.

28. An apparatus according to claim 27 wherein the TDM time slots in the first link are currently available for use in transferring data between the first network element and the third network element, and wherein the TDM time slots in the second link are currently available for use in transferring data between the third network element and the second network element.

29. An apparatus according to claim 27 wherein the comparator is further arranged to compare the TDM time slots in the first link and the TDM time slots in the second link to identify a subset of TDM time slots in the first link that are consistent with a subset of TDM time slots in the second link.

30. An apparatus according to claim 29 wherein the subset of TDM time slots in the first link that are consistent with the subset of TDM time slots in the second link form a

set of slot segments that are available between the first network element and the second network element, the apparatus further including:

a virtual link identifier, the virtual link identifier being arranged to provide the first network element with at least a first indicator which identifies the set of slot segments as being available for use in creating the path between the first network element and the second network element.

31. An apparatus according to claim 30 wherein the virtual link identifier is further arranged to provide the first network element with at least a second indicator which identifies the first TDM time slot as being available for use in creating the path between the first network element and the second network element.

32. An apparatus according to claim 31 further including:
a physical link identifier, the physical link identifier being arranged to provide the first network element with at least a third indicator which identifies the first TDM time slot as being available for use on the first link.

33. An apparatus according to claim 30 wherein the path computing device is further arranged to compute the path between the first network element and the second network element using a first slot segment selected from the set of slot segments.

34. A method for creating a circuit path segment between a source node and a destination node, the source node and the destination node being included in a bi-directional line switched ring, the bi-directional line switched ring further including at least one intermediate node, the source node being in communication with the intermediate node using a first link, the intermediate node being in communication with the destination node using a second link, the method comprising:

identifying a first channel that is available for use in transferring data, the first channel being associated with the first link;

identifying a second channel that is available for use in transferring the data, the second channel being associated with the first link;

determining when the first channel and the second channel are consistent; and

advertising the first channel as being available for use for transferring the data

5 from the source node and the destination node when it is determined that the first channel and the second channel are consistent, wherein the first channel is advertised on the source node.

35. A method as recited in claim 34 wherein determining when the first channel and
10 the second channel are consistent includes determining when the first channel is substantially the same as the second channel.

36. A method as recited in claim 34 wherein advertising the first channel as being
15 available for use for transferring the data from the source node and the destination node includes advertising the first channel as being at least a part of a virtual link between the source node and the destination node.

37. A method as recited in claim 36 further including:
20 computing the circuit path segment, wherein computing the circuit path segment includes selecting the virtual link for use in the circuit path segment.

38. A method as recited in claim 37 wherein selecting the virtual link for use in the
25 circuit path segment includes routing the circuit path segment through the first channel and the second channel.

39. A computer program product for creating a circuit path segment between a source node and a destination node, the source node and the destination node being included in a bi-directional line switched ring, the bi-directional line switched ring further including at least one intermediate node, the source node being in communication with the

intermediate node using a first link, the intermediate node being in communication with the destination node using a second link, the computer program product comprising:

computer code that causes a first channel that is available for use in transferring data to be identified, the first channel being associated with the first link;

5 computer code that causes a second channel that is available for use in transferring the data to be identified, the second channel being associated with the first link;

computer code that causes a determination to be made regarding when the first channel and the second channel are consistent;

10 computer code that causes the first channel to be advertised as being available for use for transferring the data from the source node and the destination node when it is determined that the first channel and the second channel are consistent, wherein the first channel is advertised on the source node; and

a computer readable medium that stores the computer codes.

15 40. A computer program product as recited in claim 39 wherein the computer code that causes the determination to be made regarding when the first channel and the second channel are consistent includes computer code that causes a determination to be made regarding when the first channel is substantially the same as the second channel.

20 41. A computer program product as recited in claim 40 wherein the computer code that causes the first channel to be advertised as being available for use for transferring the data from the source node and the destination node includes computer code that causes the first channel to be advertised as being at least a part of a virtual link between
25 the source node and the destination node.

42. A computer program product as recited in claim 41 further including:
computer code that causes the circuit path segment to be computed, wherein the
computer code that causes the circuit path segment to be computed includes computer
30 code that causes the virtual link to be selected for use in the circuit path segment.

43. A computer program product as recited in claim 42 wherein the computer code that causes the virtual link to be selected for use in the circuit path segment includes computer code for routing the circuit path segment through the first channel and the
5 second channel.

44. A computer program product as recited in claim 40 wherein the computer-readable medium is one selected from the group consisting of a hard disk, a CD-ROM, a DVD, a computer disk, a tape drive, a computer memory, and a data signal embodied in a
10 carrier wave.